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ABSTRACT

This report reviews the personnel literature on the development of job families to illustrate and provide examples of varied approaches to the taxonomic issues of objective, content, and method in job family construction. This booklet first examines the definition of job families and then briefly discusses the potential utility of job families. The next three sections focus on objectives of job families, content bases of job families, and grouping methods used in the construction of job families; and provide examples of each one from the literature. These sections are followed by a table which summarizes the examples of objectives, job descriptors, types of job descriptor output, grouping methods, and grouping level and cites the literature source of each variable. The concluding section explores the implications of the material reviewed for personnel selection theory and practice. This discussion focuses on four general strategies of job family construction and examines their utility for validity generalization research and application. A list of references is attached. (EM)

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JOB FAMILIES: A REVIEW AND DISCUSSION
OF THEIR POTENTIAL UTILITY FOR PERSONNEL SELECTION

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ABSTRACT

This report reviews the personnel literature on the development of job families. Viewing such development as essentially a matter of behavior classification in the world of work, the review sections focus on the basic taxonomic issues of objective, content, and method in job family construction. A variety of possible approaches to each of these issues are reviewed and illustrative examples of each approach are provided from the literature. The discussion section explores the implications of the material reviewed for a number of related objectives in personnel selection, all of which reflect different aspects of the broader objective of validity generalization. Four general strategies of job family construction are examined from the standpoint of their relative utility for validity generalization research and application.

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CONTENTS

	Page
Utility of Job Families	2
Objectives of Job Families	3
Content Bases of Job Families	6
Grouping Methods Used in the Construction of Job Families	9
Summary of Job Family Examples	10
Discussion	13
Reference Notes	18
References	18

JOB FAMILIES: A REVIEW AND DISCUSSION
OF THEIR POTENTIAL UTILITY FOR PERSONNEL SELECTION

The purpose of this report is to review the personnel literature on job families and explore such issues as the definition of a job family, the theoretical and practical utility of the job family concept, and the potential purposes, criteria, and methods which might serve as bases for constructing families of jobs. While the material reviewed was drawn from a number of different areas within industrial psychology (such as personnel selection, personnel placement, job classification, vocational guidance, job evaluation, as well as more general occupational and performance research), the discussion is primarily directed toward issues concerning employee selection.

The development of job families may be viewed essentially as an issue of taxonomy of behavior, specifically, the classification of behavior in the world of work. As such it is closely linked to methods of individual job analysis, since a determination of the characteristics of individual jobs must ordinarily precede any attempt to group jobs together on some basis of similarity. (There are a few important exceptions to this principle, however, which are discussed in a later section.)

Certain basic issues inevitably arise in any classification effort, and no less so for the classification of work behavior. These issues, as Dunnette (1976) has noted, include the determination of the objectives, content, and method of classification. Most of the review and discussion to follow is organized in terms of these three key issues, which might be thought of as the "why, what, and how" of work behavior classification. It is important to note that the basic notion of a job family presupposes no one particular way of dealing with the above issues. Rather, it is the manner in which different researchers and practitioners have resolved the questions of objective, content, and method that accounts for the many different approaches to job family construction that can be observed in the literature.

In its most basic sense, a job family is simply a group or cluster of jobs that are in some manner interrelated. For example, McCormick (1976) discusses the formation of job families as a means of relating jobs to each other at a broader level of analysis than that which defines an individual job or job type, where a job or job type can be thought of as a group of positions having reasonably common combinations of characteristics. In this regard Shartle's (1959) discussion of the relationship between positions, jobs, and occupations is instructive. He defines *position* as "a group of tasks performed by one person" (p. 23); hence, the number of positions in an organization is always equal to the number of employees in the organization. *Job* is a broader term, defined by Shartle as "a group of similar positions in a single plant, business establishment, educational institution, or other organization. There may be one or many persons employed in the same job" (p. 23). A more general term than either task, position, or job is *occupation*, defined by Shartle as "a group of similar jobs found in several establishments" p. 23).

Combining the ideas of McCormick and Shartle, we can conceive of a hierarchy based on the various possible levels of analysis at which job groupings might be made: Similar positions can be grouped together into jobs; similar jobs can be grouped into occupations, or what McCormick (1976) refers to as "job types"; and occupations or job types possessing some common combination of characteristics can be grouped together to form job families. Thus, for example, a group of office positions which primarily involve typing and general clerical tasks might be designated within a particular organization as the *clerk-typist I* job, while a group of such jobs in several organizations could be considered as belonging to the occupation or job type *clerk-typist*. At a more general level this occupation could be grouped with such other occupations as correspondence

clerk, keypunch operator, stock clerk, and accounting clerk to form what might be considered a *clerical* job family.

The formal distinctions between the above three levels of grouping (i.e., the grouping of positions into jobs, jobs into occupations, and occupations into job families) are often not explicitly recognized in the literature, and the term "job family" has been applied on different occasions to each of these levels. In view of this, the strict conception of a job family as a grouping of occupations or job types will be eschewed for the purposes of this review in favor of a broader operational definition encompassing both levels of grouping, job and occupation, in addition to the "true" job family level. This approach to the subject matter entails the review of a somewhat larger body of literature than would have been undertaken using the narrower definition of job family, but appears to be of heuristic value for our present purposes of examining the underlying bases of job groupings and exploring the utility of such groupings for personnel research and selection. The value of this approach stems from the fact that the level at which jobs are grouped in any given instance is most directly a function of the level on the job hierarchy at which job or worker data are collected (i.e., whether data are collected across positions, jobs, or occupations), which in turn is a function of the specific purpose which the grouping is intended to serve. However, the actual nature of the data to be used as the basis of grouping (e.g., task inventory responses, test scores, validity coefficients) and hence the grouping method itself are not inherently tied to the level of grouping used in any particular situation, nor are they necessarily limited in applicability to just one context. It will be therefore most useful to examine a broad range of contexts within which job families have been developed as well as the several possible levels of grouping by which they have been defined.

Following a short discussion of the potential utility of job families, later sections will focus on the issues of objective, content, and method in job family construc-

tion by giving examples of each from the literature. This will be followed by a general discussion of the implications of the material reviewed for personnel selection theory and practice.

Utility of Job Families

The exploration of systems for grouping jobs into families is desirable for both theoretical and practical reasons. Regarding the theoretical reasons, Dunnette (1976) discusses at length what he refers to as the "two worlds of human behavioral taxonomies" (p. 477), namely, the world of human attributes (as exemplified by the work of such ability theorists as Thurstone and Guilford) and that of human work performance (as exemplified by the job and task analysis research of McCormick and Fleishman and the occupational research of the U. S. Training and Employment Service). He points out that the research in these two areas has until relatively recent times proceeded rather independently, and considers the establishment of a link between these two taxonomic worlds to be one of the primary challenges facing industrial psychology today. The development of methods for classifying and grouping jobs in some systematic fashion is, according to Dunnette, an essential step in effecting this linkage. The failure to discover consistent relationships between types of work performance across jobs would all but preclude the possibility of ultimately relating such patterns of performance to corresponding attribute patterns (Fleishman, 1975). Other researchers (McCormick, 1976; Mobley & Ramsay, 1973) have similarly called attention to the need for a systematic and parsimonious approach to the study of the structure of work and the criticality of developing psychologically meaningful job families for meeting this need. Advances along such theoretical lines, beyond their value in moving the personnel field increasingly in the direction of a true science (Guion, 1976), would not be without considerable practical value as well. As Arvey and Mossholder (1977), Mobley and Ramsay (1973), and Schmidt and Hunter (1977) have pointed out, the solution of several practical problems in personnel selection, such as test¹ selection or development, combining jobs for validation purposes, and transporting

¹The terms "test" and "employee selection procedure" will be used interchangeably throughout this report to refer to any procedure or measure used as a basis for any employment decision.

test validities to new jobs and situations, rests on the development of a generalizable body of knowledge about attribute-job performance relationships.

The latter two problems--the combining of jobs for validation purposes and the transporting of validity--call attention to another aspect of the practical significance of job family development. The U. S. Equal Employment Opportunity Commission (1970) guidelines on employee selection require that empirical validation studies of employee selection procedures be conducted whenever it is technically feasible. Both the Federal Executive Agency guidelines (U. S. Department of Justice, 1976) and the recently proposed Uniform Guidelines on Employee Selection Procedures (U. S. Equal Employment Opportunity Coordinating Council, 1977) require, for criterion-related validity studies, a determination of the technical feasibility of conducting such studies in the particular employment context. However, recent research (Schmidt, Hunter, & Urry, 1976) indicates that empirical validation studies may be technically feasible far less frequently than has commonly been assumed, due to the lack of sufficient sample sizes for adequate statistical power to detect validity when it does in fact exist. In such situations it may therefore be desirable to group similar jobs together in order to obtain a sufficient sample size for validation purposes.² The proposed Uniform Guidelines also state that one of the requirements for transporting validity results for jobs in one organizational unit to similar jobs in another unit or organization, or extending the use of selection procedures validated by previous users to new jobs or situations, is the demonstration of job similarity across the different jobs or settings.³ Recent court decisions (U. S. Law Week, 1975) have upheld this principle. In order to comply with such requirements, methods are needed

for assessing the degree to which the results of previous validation studies are relevant and transportable to new jobs or settings. In such cases the importance of having some concept of job families, as well as specific procedures for determining what jobs can be reasonably considered similar, is evident (Arvey & Mossholder, 1977; Mobley & Ramsay, 1973).

Objectives of Job Families

The first question to be considered in the construction of job families is the objective for which jobs are to be grouped. Coombs and Satter (1949), in their discussion of the topic, describe the underlying philosophy of job family construction as one of the facilitating or simplifying the accomplishment of particular objectives. Similarly, Fleishman (1975) notes that a system of behavior classification (of which job families are an example) is generally not viewed as an end in itself, but is rather regarded as a tool to aid in interpretation or prediction of performance by illuminating relationships between whatever is classified and other variables of interest. Meir (1968) discusses the issue as follows:

A classification is useful only if it serves the required purpose. One of the objects of the classification is to reduce the number of discrete items or units dealt with into more or less homogeneous groups which are easier to handle. Another object of classification is to bring out the similarities and differences between the attributes of the various items after they have been sorted into groups. Most classifications in fact combine both purposes--reduction in

² The statement in the proposed Uniform Guidelines pertaining to this point is in section 14B (which applies to technical standards for criterion-related validity studies) and reads, "where appropriate, jobs with substantially the same major work behaviors may be grouped together for validity studies, in order to obtain an adequate sample."

³ The statements in the proposed Uniform Guidelines concerning this point are in section 7 and pertain to the generalization of both construct and criterion-related validity. Section 7B states that, among other general requirements, one user may apply the results of validity studies conducted by previous users when "the studies pertain to a job the incumbents of which perform substantially the same major work behaviors as shown by appropriate job analyses both on the job on which the validity study was performed and on the job on which the selection procedure is to be used." Section 7C states that for multi-unit validity studies satisfying the requirements of section 7B, "evidence of validity specific to each unit will not be required, unless there are variables which are likely to affect validity significantly."

the number of items and bringing out the similarities and differences between attributes. (p. 6)

The point here is simply that jobs are always grouped for some purpose, generally as an explanatory or interpretive aid which will hopefully serve to simplify or clarify relationships among variables or perhaps even reveal broad trends and functional relationships that might go unnoticed at a more molecular level of analysis. For a taxonomy to be a useful tool, the type of information classified (i.e., the content basis of the taxonomy) and the method by which it is classified must be appropriate for its intended purpose. Hence, formulating the objective is a necessary first step before decisions regarding content and method can be made.

A wide range of objectives and potential uses of job families have been reported in the literature. Job family systems have been developed for such applied purposes as vocational and educational guidance, the establishment of vocational training curricula, job placement, personnel classification, various personnel administration functions (such as establishing career promotion ladders and lines of transfer), internal job classification, job evaluation (for setting pay structures), personnel selection, the development of training programs, and population-level occupational data collection and analysis for economic and social purposes. They have also been used in the context of various exploratory personnel and occupational research projects, as well as for theory development and methodological research objectives. In addition, within the specific area of personnel selection, as indicated above, job families have been applied to the problem of how to combine samples across jobs to obtain sufficient sample sizes for validation studies, and to the problem of transporting validity results across jobs or situations. A few examples will help to illustrate some of these purposes.

The job family systems developed and research conducted by various military and government agencies demonstrate the utility of such efforts for the related objectives of vocational and educational guidance, job placement, training program development, personnel classification, internal job classification, job evaluation,

and personnel administration. As part of its continuing research program to develop and improve procedures for selection of enlisted persons and their classification to training courses and jobs, the Army developed procedures for grouping hundreds of its jobs, called Military Occupational Specialists (MOS), into a relatively small number of homogeneous clusters. As a result of this research (Maier & Fuchs, 1969, 1972) nine MOS groups were defined, each associated with a particular composite of subtests on the Army Classification Battery (ACB). The ACB composite for a particular MOS cluster can thus be used as the basis for classifying enlistees to an MOS in that group. As part of a Navy project to identify clusters of similar jobs, Carr (1967) developed job groupings within the engineering departments of naval destroyers as a means of classifying positions in this area of work. Along similar lines, the Air Force has conducted over a 20-year period an extensive program of research aimed at identifying and grouping similar jobs for purposes of occupational classification, identification of training needs, and personnel administration. Such "job typing analyses" have been reported (to give just a few examples) by Harding and Downey (1964), Morsh (1965), and Wiley, Jenkins, Cagwin, and Kudrick (1966), who identified job types or clusters in the engineering, personnel, and communications areas of the Air Force, respectively. Christal (1974) has given a broad overview of the whole occupational research program of which these projects were a part.

The U. S. Department of Labor has developed three separate job family systems suitable for a number of purposes. The Occupational Group Arrangement of the *Dictionary of Occupational Titles (DOT)* (U. S. Department of Labor, 1977) is a hierarchical arrangement of jobs within nine broad occupational categories which are divided into over 80 occupational divisions and further subdivided into several hundred occupational groups. These three levels of grouping are reflected in the first three digits of the DOT code for any given job title, while the second three digits of each code reflect yet another hierarchical arrangement--that of various levels of worker functioning in relation to data, people, and things. The overall Occupational Group Arrangement is thus useful for purposes of both job classification (inferring relationships among jobs) and

personnel administration (identifying entry levels and progression possibilities in the form of career ladders).

The second job family system, the Worker Traits Arrangement of the DOT (U. S. Department of Labor, 1965), identifies 114 worker trait groups organized within 22 broad areas of work. These groupings, which identify jobs possessing similar worker requirements in terms of educational background, aptitudes, knowledges, interests, temperaments, and physical demands, may also be useful for establishing job classification programs and for various personnel administration functions.

As an outgrowth of the earlier work of Trabue (1933), Dvorak (1935), Dodge (1935), Shartle (1942), and Barnette (1950), the Department of Labor (1970, pp. 179-181) has developed a third system of job families for vocational guidance purposes on the basis of its research on the General Aptitude Test Battery (GATB). This system, called the Occupational Aptitude Pattern (OAP) structure, enables counselors to make recommendations regarding an applicant's aptitude qualifications for a large number of different jobs by comparing the applicant's GATB scores with GATB norms that have been established for broad job families rather than specific jobs.

Apart from the governmental and military context, additional examples of job groupings are provided by the interest-based classifications of Kuder (1946) and Strong (1943), which have long been in use in vocational counseling settings. Also for vocational guidance purposes, Cardall (1942) constructed groupings of business jobs as part of the development of a business interest inventory. DeNisi (1976) discussed the utility of job clustering for use in industrial training programs that would enable individuals to be trained for several jobs simultaneously, while Riccobono and Cunningham (1974) have similarly reported on the use of occupational clusters for purposes of developing generalized vocational and educational curricula. Dunnette (Note 1) used groupings of nonexempt and exempt jobs in a manufacturing plant as a means of identifying those jobs in the former category which would constitute the most likely internal labor supply sources for filling jobs in the latter category, and as a means of planning rational lines of career development. Hemphill (1960),

and in an extension of Hemphill's work, Tornow and Pinto (1976), have developed taxonomies of executive and managerial jobs for use in job classification and job evaluation. A flexible job family system based on Fine's functional job analysis methodology (Fine & Wiley, 1971) has been put into operation at the Chase Manhattan Bank, where it serves a variety of personnel administrative functions (Roter, 1973).

A number of researchers have applied the job family concept to various objectives in personnel selection, or discussed its potential for such purposes. Arvey and Mossholder (1977) proposed a procedure that can test for significant differences among jobs as well as assess the extent of similarities and differences among jobs. Their procedure can be used to define job families which could then serve as the basis for combining samples across jobs for validation purposes or for determining the applicability of previous validity studies to new jobs or situations. In a similar vein, Dunnette and Kirchner (1959) clustered sales jobs of different types for the purpose of obtaining adequate sample sizes for test validation. Page (1975), starting with 104 separate clerical job classes, constructed 12 clusters or families of clerical jobs, the factor structures of which were in turn used to determine the most appropriate selection procedures to try out for each of the families. Mobley and Ramsay (1973), working with a variety of different jobs in two chemical plants, constructed relatively homogeneous clusters of jobs suitable for validity generalization purposes. Similarly, a series of studies conducted at State Farm (Colbert & Taylor, in press; Taylor, in press; Taylor & Colbert, in press) have resulted in the empirical derivation of 13 homogeneous job families from an initial 76 insurance company jobs for purposes of examining the generalizability of selection test validity within such families. Goodfellow and Grossen (Note 2) have recently proposed a job analysis methodology that will permit comparison of the factor structure of different jobs to assess potential for validity generalization.

Lawshe and Balma (1966, pp. 258-259) and McCormick (1959) have related the construction of job families to what has been termed synthetic or job-component validity, which is a process of analyzing jobs into their components or elements, determining the appropriate human attribute requirements

for each job component, and synthesizing these requirements into an attribute pattern for the total job. The validity of various selection devices is then inferred on the basis of their predetermined relationships with the attribute requirements. Job families from this point of view would consist of jobs found to have similar patterns of components and hence, similar attribute patterns, and which would therefore lend themselves to common selection procedures. The above-cited research conducted at State Farm was essentially based on this conceptualization of job families. A similar application has been reported by Cunningham, Phillips, and Spetz (1976), who also examined the possibility of establishing criterion-related validity within groups of similar job classes as part of a larger project concerning the construct validity of the job-component approach to estimating the ability requirements of jobs.

Numerous examples of job family development for specific research purposes have been reported in the literature. Many of these studies (Arvey & Mossholder, 1977; Chalupsky, 1962; Coombs & Satter, 1949; DeNisi & McCormick, 1974; Guilford, Christenson, Bond, & Sutton, 1954; Landy, 1972; McCormick, Finn, & Scheips, 1957; Mobley & Ramsay, 1973; Norman, 1960; Orr, 1960; Palmer & McCormick, 1961; Remstad & Rothney, 1958; Seymour, Gunderson, & Vallacher, 1973; Thomas, 1952; Thorndike, 1953; Thorndike, Hagen, Orr, & Rosner, 1957; Thurstone, 1931) were undertaken primarily to illustrate particular grouping strategies, job analysis methods, or measurement techniques that might prove useful as means of constructing job families. Ghiselli (1966, p. 14), Thorndike and Hagen (1959), and Schmidt and Hunter (Note 3) have used job families primarily as a means of data reduction to facilitate the analysis, presentation, and interpretation of the authors' particular research. Some researchers (Holland, Viernstein, Kuo, Karweit, & Blum, 1972; Roe, 1956; Schoenfeldt, 1974) have developed job family systems for purposes of model or theory development within specified areas of research. Others (Farina & Wheaton, 1973; Fleishman, 1975; Levine, Romashko, & Fleishman, 1973; McCormick, 1959; Schmidt & Hunter, 1977) have viewed job family development in terms of the broader theory construction and taxonomic linkage functions discussed earlier.

Finally, such job family structures as can be observed in the Occupational Group Arrangement of the DOT (U. S. Department of Labor, 1977), the *Classified Index of Industries and Occupations* published by the U. S. Bureau of the Census (1971), the *International Standard Classification of Occupations* (International Labour Office, 1969), the *Standard Occupational Classification Manual* (U. S. Department of Commerce, 1977), and the *Canadian Classification and Dictionary of Occupations 1971* (Canada Department of Manpower and Immigration, 1973) illustrate the use of such systems for the collection and analysis of general occupational data of all kinds at the population level. These job family structures are used by government agencies, universities, businesses, and research organizations for census-taking and statistical survey purposes, program and policy development, employee utilization research, forecasting occupational supply and demand, evaluation of employment conditions and technological trends, and relating results of independent research projects to each other.

Content Bases of Job Families

The question of the content basis of a job taxonomy or job family system concerns the job characteristics, units of analysis, or descriptive criteria on which the system will be built. McCormick (1976) refers to such characteristics collectively as *job descriptors*, and considers them to be "the common denominators for bundling jobs together into specific job categories, and in some instances for relating these categories to each other into a total classification system or taxonomy" (p. 680). As Dunnette (1976) points out, the choice of descriptors in taxonomic development is an extremely important issue, since it sets limits on the way in which any taxonomy may be used. There are a large number of possible job descriptors or combinations of such descriptors which might conceivably serve as bases for grouping jobs into families. For example, jobs could be grouped in terms of similarities in income level, incumbent interest patterns, amount of training or previous experience required, physical working conditions, tasks or behaviors performed, level of responsibility or decision-making involved, industry in which they are located, goods produced or services rendered, aptitudes required, physical effort entailed, and so

forth. Obviously, the type of job descriptor or descriptors used in any given instance must be determined on the basis of the intended function of the taxonomy. A job taxonomy based on income level would not likely prove useful for selection purposes, nor would a taxonomy based on the interest patterns of incumbents facilitate the development of a job evaluation system for setting pay schedules.

Most of the job descriptors commonly used as bases for job family construction fall into one of four broad categories, as adapted from McCormick (1959, 1976). Job descriptors may reflect the *job-oriented content* of jobs by characterizing work activities in "job" terms, that is, in terms of work outcomes--what work is accomplished--rather than what the worker does to accomplish it. Job-oriented content descriptors may also reflect the purpose, procedures, materials, conditions, and level of responsibility involved in the work activities. Such descriptors are therefore usually tied to job-specific technologies, resources, contexts, products, or services. Such task element statements as are found in the DOT job definitions (e.g., "turns valves to regulate flow of pulp slush from main supply line to pulp machine headbox") and in Air Force job inventories (e.g., "install cable pressurization systems") are typical of descriptors of this type. Job descriptors may also reflect the *worker-oriented content* of jobs by describing work activities in "worker" terms, or in terms of the human behaviors, elemental motions, or personal job demands involved in accomplishing the work. Worker-oriented content descriptors are generally more process-oriented and less job-specific than job-oriented content descriptors. Typical descriptors of this type are such job elements as comprise the Position Analysis Questionnaire (see below), for example, "judging condition/quality," "assembling/disassembling," "attention to detail," "following set procedures," and "working under distractions." A third category of job descriptors is that of the *attribute requirements of jobs*, consisting of those descriptors which characterize work activities in terms of the human attributes related to their performance.⁴ This category

encompasses such factors as education, training, experience, abilities, personality traits, interests, and physical characteristics. Finally, job descriptors may reflect the *overall nature of the job* by broadly characterizing jobs in terms of their job titles or general descriptions of the nature of work or groups of activities performed.

It should be noted that distinctions among these categories, particularly between the first and second (job- vs. worker-oriented content) and between the second and third (worker-oriented content vs. attribute requirements), may not always be clear-cut. Content statements or descriptions of job activities may contain elements of both a job-oriented and worker-oriented nature, the difference frequently being only a matter of language or emphasis. Similarly, worker-oriented content descriptors may overlap with attribute requirement descriptors, since human work behavior in its broadest conception encompasses both overt physical and covert cognitive responses (cf. the definitions in English & English, 1958, under "act," "activity," "work," and "work/mental"). These caveats notwithstanding, the suggested categorization of job descriptor types appears to be useful for purposes of structuring the present review.

In addition to differentiating job descriptors in terms of the above four categories, we can also differentiate them in terms of the means by which they are described or measured, that is, the nature of the information they produce or the data output which will actually be used as the basis for combining jobs into families. Broadly speaking, we can think of such information or output as being of two types. The first is information that is primarily qualitative, such as narrative or descriptive statements about the activities, context, or requirements of a job. The second is primarily quantitative information, such as responses to a job activities checklist, job analyst ratings of the trait requirements for a job, incumbent scores on an ability test or interest inventory, or correlations between such scores and measured job performance. We will now consider a number of examples which

⁴The use of the term "attribute requirements" here and throughout this report, while perhaps connoting a necessity to possess some absolute level of various attributes for successful job performance, should not be interpreted as implying anything other than the linear probabilistic model of the relationship between individual differences and job performance that has been generally characteristic of the data in this area (cf. Hawk, 1970).

illustrate both the different categories of job descriptors as well as the different types of job descriptor output that have typically been used in job family development.

The job-oriented content class of descriptors is perhaps best illustrated by the use of inventories or checklists of job tasks or work activities. These are generally completed by incumbents, who simply check off those tasks or activities which they actually perform on their jobs, and in many cases also rate the tasks they have checked according to such factors as relative time spent, relative difficulty, or relative importance of the task to the total job. The Air Force research on job types (Harding & Downey, 1964; Morsh, 1965; Wiley et al., 1966) is typical of this approach. Prien (1963) has similarly employed a checklist of worker functions to identify common job functions across supervisory positions. Job-oriented checklists have also been used to group sales jobs (Dunnette & Kirchner, 1959), executive positions (Hemphill, 1960), and clerical jobs (Cardall, 1942; Prien, 1965; Thomas, 1952).

The use of descriptors of worker-oriented content is best exemplified by the research of McCormick and his associates (DeNisi & McCormick, 1974; Marquardt & McCormick, 1974; McCormick, Jeanneret, & Mecham, 1972) on the Position Analysis Questionnaire (PAQ), a structured job analysis instrument consisting of 194 worker-oriented job elements organized within six broad divisions. While the extensive research on the PAQ has been directed toward a number of objectives (such as synthetic or job-component validity, job evaluation, and broader research on the structure of work), that which has been specifically directed toward job family development (cf. Cunningham et al., 1976; DeNisi & McCormick, 1974; Taylor, in press; Taylor & Colbert, in press) has demonstrated the potential utility of employing worker-oriented job descriptors as bases for grouping jobs. Other examples of the use of such descriptors are provided by Chalupsky (1962), Dunnette (Note 1), Page (1975), and Roter (1973), all of whom employed worker-oriented task or job activity checklists to produce data suitable for use in job grouping.

Many instances of descriptors which reflect the worker attribute requirements of jobs have been reported in the literature, and such descriptors are illustrative of several types of information output. In some cases (American Bankers Association, 1977; Desmond & Weiss, 1973; McCormick, Finn, & Scheips, 1957; Paterson, Gerken, & Hahn, 1953; Thorndike, 1953) the importance of a variety of attribute requirements for a wide range of jobs has been rated directly by supervisors, judges, or job analysts. In other cases (Barnette, 1950; Gailford et al., 1954; Holland et al., 1972; Kuder, 1946; Norman, 1960; Seymour et al., 1973; Strong, 1943; Thurstone, 1931; Trabue, 1933) the descriptor output has consisted of scores on various measures of cognitive or motor ability, personality, or interests.

In a few cases the concept of job families based on similarities in patterns of test scores has been extended to the idea of using actual test-job performance correlations as a basis for job grouping. Ghiselli (1966, pp. 93-111) employed such a technique by using intercorrelations between average validity coefficients for different tests and jobs as a basis for clustering jobs having similar patterns of validity results. Maier and Fuchs (1972) used similarities in ACB validity patterns for different MOS as a check on rationally derived Army job families and as a basis for assigning additional MOS to existing families. Schmidt (Note 4) has similarly suggested forming families of jobs which possess comparable patterns of true validities, as estimated by the general procedure used for assessing validity generalizability described by Schmidt and Hunter (1977).

The fourth category of job descriptor is that of the overall nature of the job. The use of descriptors of this type for job family development are most readily observed in government job classification systems (cf. Canada Department of Manpower and Immigration, 1973; U. S. Bureau of the Census, 1971; U. S. Civil Service Commission, 1973; U. S. Department of Commerce, 1977; U. S. Department of Labor, 1977), which typically classify and group jobs on the basis of similarities in the types of general work activities performed. In addition, some researchers, such as Ghiselli (1966, p.14) in his "General Occupational Classification," Schmidt and Hunter (Note 3), and Thorndike and Hagen (1959), have based job families on

descriptors of this nature for purposes of presentation or analysis of research results where specificity of job- or worker-oriented content or attribute requirements was not essential to the research aim.

Grouping Methods Used in the Construction of Job Families

The final taxonomic issue to be examined concerns the methods employed to group jobs into families once they have been described in terms of one of the job descriptor categories discussed above and have produced some type of output on the basis of which grouping is possible. It is apparent that the type of job grouping method employed is necessarily related to the descriptor output produced, and we can again conceive of a broad classification corresponding to the qualitative-quantitative distinction made with regard to descriptor output. Jobs may thus be viewed as being grouped either on the basis of some rational or judgmental process, as would most likely be (but is not limited to) the case when the descriptor output is of a qualitative nature; or they may be grouped using one of several available statistical or quantitatively based procedures (such as factor or cluster analysis, analysis of variance, or profile matching), as would be possible with quantitative descriptor output. (It is beyond the scope of this presentation to discuss the relative statistical merits of the various quantitative grouping methods; however, these issues are treated by Arvey & Mossholder, 1977, Blashfield, 1976, Borgen & Weiss, 1971, DeNisi & McCormick, 1974, and Mobley & Ramsay, 1973).

In addition to the method of grouping employed, it is possible, as indicated earlier, to describe job family systems in terms of the level of analysis at which job groupings are constructed, that is, at the level of jobs (i.e., groupings of positions), job types or occupations (groupings of jobs), or job families (groupings of occupations). The following examples therefore illustrate both the method and level of job grouping employed in job family construction.

The most common instances of jobs grouped by rational methods are the same as those noted above as examples of job descriptors which reflect the overall nature of the job; namely, the government classifications and the classifications developed

for data reduction or presentation purposes as part of a broader research project. The job groupings in most of these cases are at the job family level (cf. Ghiselli, 1966, p. 14; Thorndike & Hagen, 1959), although in the DOT, the *International Standard Classification of Occupations*, the *Standard Occupational Classification Manual*, the Canadian system, the U. S. Civil Service Commission system, and the *Classified Index of Industries and Occupations*, the classification system is actually hierarchical, and job groupings are made at the occupational level as well.

In the past 25 years or so, job family development has become based increasingly on objective statistical techniques, in contrast to the subjective methods common in earlier times (cf. Bingham, 1935). This is partially a reflection of similar developments that have characterized the area of job analysis in general and which have increasingly resulted in types of data output suitable for job grouping, such as structured job analysis questionnaire responses. It is also an outcome of the development of new techniques for determining similarities between jobs, such as those described by Arvey and Mossholder (1977), Cronbach and Gleser (1953), Goodfellow and Grossen (Note 2), and Ward (1963). Although factor and cluster analytic methods had been available earlier, prior to the 1950s they were rarely used for job grouping purposes, with the exception of the vocational guidance field, where factor analyses of vocational interest inventories to determine broad occupational interest categories were not uncommon (cf. Strong, 1943; Thurstone, 1931).

More recently, factor analysis, based on the intercorrelations among the variables composing the job descriptor measure, frequently has been used as a means of identifying common dimensions of job- or worker-oriented content or attribute requirements across positions, jobs, or occupations. Such analyses have been carried out at the occupational level of grouping by using job-oriented checklist data from different jobs in the clerical (Prien, 1965) and business executive (Hemphill, 1960) areas. Factor analysis has also been used to identify groupings of jobs at the family level on the basis of either worker-oriented checklist data (Palmer & McCormick, 1961) or attribute requirements ratings (American Bankers Association, 1977; McCormick, Finn, & Scheips, 1957) gathered across different occupations.

Cluster analytic techniques for grouping jobs have also come to be widely used in recent years. Typically, such techniques have been based on calculation of some distance measure, such as d^2 (Cronbach & Gleser, 1953; Osgood & Suci, 1952) or a correlational index (as is used in the clustering technique described by Tryon & Bailey, 1970) to determine the degree of relationship between job profiles in terms of whatever variables characterized the particular job descriptor used. Ward's (1963) hierarchical grouping procedure, an iterative clustering method, has been incorporated into the Air Force's Comprehensive Occupational Data Analysis Program (CODAP) (Christal, 1974) and has been used to cluster analyze numerous Air Force jobs using incumbents' task inventory responses. Archer, 1966, has provided a detailed demonstration of the Air Force's job typing methodology.) Tornow and Pinto (1976) also used Ward's procedure to form clusters of managerial positions at the job level of grouping, while Taylor (in press) employed a modification of this procedure to group insurance company occupations into job families. Dunnette and Kirchner (1959), Page (1975), and Thomas (1952) constructed via cluster analysis groupings of sales and clerical jobs at the occupational level using job- and worker-oriented checklist data. In addition, various types of attribute requirements data (attribute ratings, personality and interest inventory scores, and validity coefficients) have been used as the basis for clustering occupations at the job family level (Ghiselli, 1966, pp. 93-111; Mobley & Ramsay, 1973; Norman, 1960; Orr, 1960; Seymour et al., 1973; Thorndike, 1953).

Other quantitative job grouping methods are Arvey and Mossholder's (1977) analysis of variance procedure, which compares multiply rated PAQ dimensions of different jobs, and the attribute rating comparison methods employed by Desmond and Weiss (1973), which were used for purposes of rational development of occupational aptitude patterns rather than explicitly for job family construction, but are potentially useful for the latter purpose. In addition, various techniques of profile or pattern matching of scores on different attribute measures were commonly used in the earlier days of occupational aptitude pattern research (Barnette, 1950; Dodge, 1935; Dvorak, 1935; Paterson et al., 1953; Shartle, 1942; Trabue, 1933) to group jobs at the occupational or family level. In some cases

patterns of validity coefficients or correlations from interest inventory data were used to confirm or refine job family groupings previously developed by rational means (Holland et al., 1972; Kuder, 1946; Maier & Fuchs, 1972). In other cases aptitude test validity and normative data or job analysts' ratings of attribute requirements have been used in conjunction with qualitative job analysis information to develop job family structures (U. S. Department of Labor, 1965, 1970, pp. 179-181).

Summary of Job Family Examples

As a means of summarizing the examples presented in the preceding sections for easier reference and comparison purposes, a coding system was developed to reflect the different job family variables that have been discussed, and each of the examples has been classified accordingly. This summary is presented in Table 1. The many possible objectives of job family development have been condensed into a smaller number of categories of related objectives. The various categories of job descriptors, types of job descriptor output, grouping methods, and levels of grouping are based on the earlier discussion of these variables. In addition, a code for "nonspecified" has been included in each of these last four categories for cases in which the nature of a variable was either not specified in the source reference (for example, instances in which the use of job families for particular objectives was discussed, but no one descriptor, method, or grouping level was suggested) or the variable lent itself to several possible categories (for example, cases in which several levels of grouping were possible depending on the specific nature of the job descriptor output). In examples for which more than one category of a variable is appropriate, all are listed in the summary table.

TABLE 1

Summary of Examples of Objectives, Job Descriptors,
Types of Job Descriptor Output, Grouping Methods,
and Grouping Levels in Job Family Construction

<u>Objective (O)</u>	<u>Job Descriptor (D)</u>
1 = vocational/educational guidance, job placement, training, or related research	1 = job-oriented content
2 = job classification/evaluation, personnel administration, or related research	2 = worker-oriented content
3 = personnel selection or selection research	3 = attribute requirements
4 = population-level occupational data collection/analysis	4 = overall nature of job
5 = theory construction, exploratory occupational/methodological research	5 = nonspecified

<u>Job Descriptor Output (DO)</u>	<u>Grouping Method (M)</u>	<u>Grouping Level (L)</u>
1 = qualitative job analysis information	1 = rational	1 = job
2 = responses to structured job/task analysis checklist or questionnaire	2 = factor analysis	2 = occupation/job type
3 = judge/job analyst ratings of job- or worker-oriented content or attribute requirements	3 = cluster analysis	3 = job family
4 = scores on test or personality/interest inventory	4 = analysis of variance	4 = nonspecified
5 = validity coefficient	5 = profile/pattern matching of job/task, rating, test, or validity data	
6 = nonspecified	6 = combination of rational and profile/pattern matching	
	7 = nonspecified	

<u>Source</u>	<u>O</u>	<u>D</u>	<u>DO</u>	<u>M</u>	<u>L</u>
American Bankers Association (1977)	3	3	3	2	3
Arvey & Mossholder (1977)	3	2	2	4	3
Barnette (1950)	1	3	4	5	4
Bingham (1935)	2	1	1	1	2
Canada Dept. of Manpower and Immigration (1973)	4	4	1	1	2,3
Cardall (1942)	1	1	2	3	2
Carr (1967)	2	1	2	3	1
Chalupsky (1962)	5	2,3	2	2	2
Christal (1974)--CODAP job clustering program	1,2	1	2	3	1,2
Coombs & Satter (1949)	5	2,3	3	2	3
Cunningham et al. (1976)	3	1,2	2	3	3
DeNisi (1976)	1	5	6	3	4
DeNisi & McCormick (1974)	5	2	2	3	3
Dodge (1935)	1	3	4	5	3

(cont'd. next page)

TABLE 1 (cont'd.)

Source	O	D	DO	M	L
Dunnette (Note 1)	2	2,4	1,2	1,3	2
Dunnette & Kirschner (1959)	3	1	2	3	2
Dvorak (1935)	1	3	4	5	3
Farina & Wheaton (1973)	5	1	5	5	4
Ghiselli (1966)--General Occupational Classification	5	4	1	1	3
Ghiselli (1966)--Cluster analysis	5	3	5	3	3
Goodfellow & Grossen (Note 2)	3	3	2,3	2	4
Guilford et al. (1954)	1	3	4	2	3
Harding & Downey (1964)	1,2	1	2	3	2
Hemphill (1960)	2	1	2	2	2
Holland et al. (1972)	1	3	4	6	3
International Labour Office (1969)	4	4	1	1	2,3
Kuder (1946)	1	3	4	6	3
Landy (1972)	5	3	4	3	3
Lawshe & Balma (1966)	3	3	6	7	4
Levine et al. (1973)	5	3	3	5	4
McCormick (1959)	3	5	6	7	4
McCormick et al. (1957)	5	3	3	2	3
Maier & Fuchs (1972)	1,2,3	3,4	1,5	6	3
Mobley & Ramsay (1973)	3	1,3	3	3	3
Morsh (1965)	1,2	1	2	3	2
Norman (1960)	1	3	4	3	3
Orr (1960)	5	3	3	3	3
Page (1975)	3	2	2	3	2
Palmer & McCormick (1961)	5	2	2	2	3
Paterson et al. (1953)	1	3	3	5	3
Prien (1963)	5	1	2	2	1
Prien (1965)	5	1	2	2	2
Remstad & Rothney (1958)--Remstad's classification	5	3	1	1	3
Riccobono & Cunningham (1974)	1	1,2,3	2	2	4
Roe (1956)	5	3,4	1	1	3
Roter (1973)	1,2	2	3	5	4
Schmidt (Note 4)	3	3	5	5	3
Schmidt & Hunter (1977)	3,5	4	1	1	2
Schmidt & Hunter (Note 3)	3,5	4	1	1	2,3
Schoenfeldt (1974)	1	5	6	3	4
Seymour et al. (1973)	5	3	4	3	3
Shartle (1942)	1	3	4	5	3
Strong (1943)	1	3	4	2	3
Taylor & Colbert (in press)	3	2	2	3	3
Thomas (1952)	5	1	2	3	2
Thorndike (1953)	5	3	3	3	3
Thorndike & Hagen (1959)	5	4	1	1	3
Thorndike et al. (1957)	5	1	2	3	3
Thurstone (1931)	1	3	4	2	3
Tornow & Pinto (1976)	2	1	2	3	1
Trabue (1933)	1	3	4	5	2
U. S. Bureau of the Census (1971)	4	4	1	1	2,3
U. S. Civil Service Commission (1973)	2	4	1	1	2,3
U. S. Department of Commerce (1977)	2,4	4	1	1	2,3
U. S. Dept. of Labor (1977)--Occupational Group Arrangement	2,4	4	1	1	2,3
U. S. Dept. of Labor (1965)--Worker Traits Arrangement	1,2	3	3	6	3
U. S. Dept. of Labor (1970)--OAP Structure	1	3	4	6	3
Wiley et al. (1966)	1,2	1	2	3	2

Discussion

The examples reviewed in the preceding sections strikingly illustrate the great diversity of objectives, job descriptors, and methods that can be seen to characterize the job family literature. They also confirm the early observation of Toops (1945), which has since been echoed by most researchers in the area (cf. Coombs & Satter, 1949; Jeanneret & McCormick, 1969; Meir, 1968; Mobley & Ramsay, 1973), to the effect that the overall grouping strategy (a term which will be used here to encompass the type of job descriptor, job descriptor output, and grouping method used) of any job family structure will vary with the situation and purpose for which it is designed.

A further point is that many of the examples reviewed provide empirical evidence for the perhaps intuitively obvious but often overlooked conclusion that different grouping strategies are likely to produce very different groupings of jobs, even when the input data (i.e., jobs to be clustered) are identical. For example, within the three Labor Department job family systems described earlier each of the job families defined by Worker Traits Arrangement groups of the DOT, and therefore based on a variety of attribute requirements, contain jobs that cut across several job families as defined by the Occupational Group Arrangement, which are based on the overall nature of the job. In addition, each of the job families defined by the Occupational Aptitude Pattern structure, and hence based on common patterns of specific GATB aptitudes, contain jobs that cut across both Worker Trait Arrangement and Occupational Group Arrangement families.

Another example of this phenomenon is provided by Ghiselli (1966), who found that his rational grouping of jobs into families, according to similarity in the nature of the work performed (i.e., his "General Occupational Classification") was completely altered when the same jobs were clustered according to similarity in the average validity patterns of intellectual-perceptual, spatial-mechanical, and motor ability tests for these jobs:

The jobs contained in either of the main clusters, and, indeed, in most of the subclusters seem strange bedfellows. By and large the clusters and subclusters are made up of jobs with little apparent similarity.

Certainly the clusters do not correspond with the presumed logical organization of jobs as given by the General Occupational Classification system.... Others have reported this same finding, that jobs grouped on the basis of similarity in objectively measured abilities have little superficial similarity in terms of the nature of the work. It is only their similarities in ability requirements, as indicated by the validities of the three types of tests, that leads to the jobs being groups as they are here. (p. 106)

There is also evidence in the literature that the different job groupings produced when different descriptors or methods are used can have significant effects on research or study outcomes. Remstad and Rothney (1958) provide a convincing example of this point in their study of consistency of occupational choice relative to previously stated occupational preference and father's occupation. They found dramatic differences in the results obtained depending on which of three different job family systems was used as the basis of classification.

To recapitulate, the examples of job families reviewed provide evidence that: 1) the different objectives for which families of jobs may be constructed necessitate different job descriptors and methods of grouping (i.e., the grouping strategy must be tailored to the purpose at hand); 2) the resulting job groupings in turn will vary as a function of the job descriptors and methods employed; and 3) research results and study outcomes based on the analysis of grouped jobs are likely to vary as a function of the nature of the job groupings used in the analysis.

Although these conclusions are derived from an examination of a number of areas within industrial psychology, they apply equally as well to various objectives within the more specific area of personnel selection. It is therefore now possible to attempt to evaluate the relative applicability and utility of different job grouping strategies for such objectives. As indicated earlier, these objectives include facilitation of test development or selection for groups of jobs, combining jobs to obtain sufficient sample sizes for validation purposes, determining the relevance of previous

validation studies to additional jobs, and determining the transportability of validity results for similar jobs within or across organizations.

On closer examination each of these objectives can be seen to reflect different aspects or applications of one central conceptual issue, that is, validity generalization. As Lawshe and Balma (1966, p. 252) have defined it, validity generalization entails the induction of a test's validity to a family of jobs from its validity for individual jobs, and the consequent deduction of validity for additional jobs based on their similarity to the job family.

Attempts to develop or choose a test that will ultimately be used to select personnel within a group of jobs contain the implicit assumption or hope that the validity of such a test will generalize to all of the jobs in the group. A similar assumption is implicit in any procedure used to combine jobs for purposes of obtaining an adequate validation sample, namely, that such a grouping of jobs would not attenuate the validity that might be obtained for each of the jobs individually were an adequate sample available. The relationship to validity generalization of the last two objectives, extending the use of previously validated selection procedures to additional jobs or settings and transporting validity results across similar jobs in different organizations or organizational units, is virtually direct, each application representing just a slightly different variation of the basic concept of validity generalization. The former objective entails generalization to new jobs; the latter entails generalization to new locations or situations.

In view of this, we will now briefly examine each of the various studies that have attempted to apply some job grouping strategy to one or more of the above aspects of validity generalization. Both the type of job descriptor used in each instance, as well as the results obtained in terms of validity generalization, will be noted. On the basis of this review, and in conjunction with additional research evidence, some conclusions will be drawn regarding the applicability and relative utility of different grouping strategies for such purposes. Finally, suggested directions for future applied work in this area, as well as more theoretical validity generalization research, will be presented.

There have been only a few reported attempts to develop clusters of jobs for validity generalization purposes on the basis of job-oriented content descriptors. Dunnette and Kirchner (1959), by cluster analyzing job-oriented sales checklist data, isolated several types of sales jobs having similar functions. They concluded that different jobs within the identified job type groups would be combinable for test validation purposes; however, no validation work was carried out as part of this study. Cunningham et al. (1976), as one part of a larger study, used the Occupation Analysis Inventory (OAI), a job-oriented content type of job analysis instrument, as a basis for clustering 25 jobs within a State merit system program. They found about one-third of the bivariate test-criterion correlations (i.e., those between individual Differential Aptitude Test subtests and a composite criterion) to be statistically significant within OAI-based job clusters; however, few of the multiple correlations for these clusters held up under cross-validation. The authors partly attribute the latter results to relatively small sample sizes, range restriction effects (this was a concurrent validation study), and possible criterion measurement problems.

A few studies have explored the utility for validity generalization of job families based on worker-oriented content. Arvey and Mossholder (1977) applied their analysis-of-variance methodology to eight PAQ-rated jobs in a paper mill company and found no significant differences among the jobs, thus supporting the feasibility of combining employees working in these jobs for purposes of conducting a validation study. However, no such study was carried out as part of this analysis. Cunningham et al. (1976), in addition to their OAI-based multiple regression analysis of validity generalization noted above, performed a similar study with groupings of jobs based on a PAQ analysis. Their findings were essentially the same as those obtained with the OAI, that is, mostly significant multiple correlations of which few held up under cross-validation. Page (1975) used the factor structure of worker-oriented clerical job clusters for test selection purposes, but then attempted to validate the selected tests for individual job classes only, rather than for the entire clusters. Colbert and Taylor (in press), after clustering insurance company jobs on the basis of company-specific PAQ dimensions (Taylor & Colbert, in press),

examined the validity generalizability of several aptitude tests for two clerical job families. They hypothesized and found that prediction equations based on a portion of each of the families cross-validated to other jobs within the same family. Additional hypotheses regarding the ability of job family membership to moderate the relationship between test and job performance (i.e., hypotheses of divergent validity between job families) were not as clearly supported. However, as the authors note, there were not very great dissimilarities between the two families to begin with (one family consisted primarily of secretarial jobs, and the other file and record clerk jobs); this would tend to militate against a finding of divergent validity between such families, as is consistent with the results reported by Schmidt and Hunter (Note 3), discussed below.

Several studies have suggested or examined the use of attribute-based job families for validity generalization purposes. Mobley and Ramsay (1973) developed clusters of chemical plant jobs suitable for validity generalization or sample-combining purposes on the basis of supervisor-rated attribute requirements (five of the 20 rating elements were actually of a job-oriented content nature); however, this was primarily a methodological study of the utility of a particular grouping method (Ward's hierarchical clustering procedure), and no validity generalization study was conducted. Goodfellow and Grossen (Note 2) have proposed a methodology by which attribute requirements (as derived from detailed task and behavior analyses) would be used as the basis for establishing groups of similar jobs to which common selection procedures could be applied (i.e., job groups within which validity would be likely to generalize). Their initial application of this methodology with teacher jobs in two California school districts is still in progress and no results in terms of validity generalization are yet available. The American Bankers Association (1977) found generalized test battery validities for a number of administrative and performance criteria within attribute-based families of entry-level banking jobs. However, these results are difficult to interpret because they are based on canonical correlations of questionable appropriateness and multiple regression equations utilizing large numbers of predictors without any cross-validation.

As an example of the use of job families based on the overall nature of the job, for years the Army has been routinely generalizing ACB validities within the broadly defined occupational areas (e.g., clerical, general technical, electronics) of its MOS structure. In spite of the diversity of jobs within each of these families, Maier and Fuchs (1969, 1972) reported the establishment, using cross-validated multiple regression techniques, of a unique ACB composite for each job family. Each of these composites yielded relatively high generalized validity for the prediction of training school success within each of the families. Schmidt and Hunter (Note 3) have employed a similar approach to job families as Maier and Fuchs, although their aim was more one of basic theoretical research on validity generalization, in contrast to the applied orientation of most of the previous examples. In one set of results based on data collected by the present author, clerical job families were defined in terms of an existing occupational classification structure--the Occupational Group Arrangement of the DOT. All available published and unpublished validity coefficients pertaining to five types of tests (general mental ability, verbal ability, quantitative ability, perceptual speed, and motor ability) and two DOT clerical job families (stenography, typing, filing, and related occupations; and computing and account-recording occupations) were compiled for each of the ten resulting test-job family combinations and analyzed for validity generalizability using the correction procedures described by Schmidt and Hunter (1977). In all but possibly one of the ten corrected distributions of validity coefficients, the estimated true validity was sufficiently high and the variance sufficiently low to allow a conclusion of generalizability of validity to additional jobs in the same family.

The above examples unfortunately do not provide a great deal of data on which to evaluate the relative merits of different grouping strategies for validity generalization purposes. Only five studies located to date have produced analyses that go beyond the job grouping stage to empirically assess the generalizability of selection test validities within job families. As noted above, the results of the ABA and Cunningham et al. studies were rather equivocal. This leaves only the results reported by Colbert and Taylor, who used job groupings based on worker-oriented job content, and those

reported by Maier and Fuchs and by Schmidt and Hunter, both of which were based on job families derived from the overall nature of the component jobs, as constituting clear demonstrations of generalizable validity within families of jobs.

However, the data from some of these studies, in combination with evidence from other sources, suggests some limitations to the usefulness of job-oriented and worker-oriented content as bases for constructing job families which are optimal for validity generalization purposes. This evidence has to do with the fact that neither job-oriented content descriptors (which are typically tasks or duties) or worker-oriented content descriptors (such as elements of the PAQ or "critical incidents") are isomorphic with the individual difference factors underlying successful job performance, that is, those factors which differentiate superior from inferior workers. A number of examples can be given to illustrate this point.

The results of the analysis by Ghiselli (1966, p. 106), quoted above, demonstrated that job groupings initially constructed by rational means were radically redefined when similarity in ability patterns across jobs was used as the basis of grouping. One of Ghiselli's conclusions from this research was that jobs which appear to be quite different in terms of the nature of the work or activities performed may, in fact, have very similar ability requirements. The job families derived in the studies by Arvey and Mossholder (1977), DeNisi and McCormick (1974), McCormick, Finn, and Scheips (1957), and Mobley and Ramsay (1973) support Ghiselli's findings. In each of these studies, jobs characterized by widely divergent activities in terms of the nature of the work performed (e.g., carpenters, electricians, pipefitters, machinists, welders, and millwrights in the Arvey and Mossholder study) clustered together when grouped according to either worker-oriented job content or attribute requirements.

The data reported by Schmidt and Hunter (Note 3), in addition to demonstrating validity generalization within clerical job families, also showed that estimates of the true validities for each of the five different test types were extremely similar across the two clerical job families studied, revealing that what-

ever differences in job activities exist between these two areas of clerical work have little impact on their ability requirements. The Maier and Fuchs (1969, 1972) studies demonstrated that a large number of different Army MOS could be clustered into a small number of groups that were relatively homogeneous with respect to their ACB validity patterns. Fleishman (1975) has similarly observed: "Through our investigation of a wide range of several hundred different tasks, we have been able to account for performance in terms of a relatively small number of abilities" (p. 1131).

This evidence indicates that while test validities are likely to generalize within groups of jobs that are very homogeneous with respect to their job-oriented or worker-oriented content (the findings of Colbert & Taylor, and to some extent those of Cunningham et al., tend to bear this out), such groupings are *unnecessarily restrictive* for validity generalization purposes. This is because, as the above examples illustrate, particular configurations of attribute requirements may have validity for jobs representing a diverse range of tasks, duties, and worker-oriented characteristics.

It should be noted that a job- or worker-oriented content approach to job analysis does not preclude the development of job families based on attribute requirements. However, the nature of the descriptor output resulting from such approaches (whether tasks, duties, critical incidents, or worker-oriented elements) is such that an "inferential leap" (Dunnette, Note 1; Prien, 1977; Tenopir, 1977) that links such output to the individual difference factors critical to successful job performance still remains to be made after the completion of the analysis. This is in contrast to the various attribute requirement approaches (e.g., expert ratings, incumbent test or inventory scores, or validity data), wherein such inferences are obtained directly as part of the analysis. Therefore, if one is analyzing a number of jobs using a job- or worker-oriented job analysis method and yet does not want to unnecessarily narrow down the range of validity generalization possibilities within these jobs by grouping them directly on the basis of the resulting job analysis output, two additional steps need to be taken: 1) determining which of the many job- or worker-oriented content elements likely to be present on a given job actually differentiate superior from

inferior workers, and 2) linking these differentiating elements to their underlying attribute requirements.

The necessity to employ such procedures in constructing a job analysis system that will be useful for personnel selection purposes has been recognized by both McCormick (cf. Marquardt & McCormick, 1974), in his development of the PAQ job analysis methodology, and Fleishman in his Task Assessment Scales (cf. Theologus & Fleishman, 1971). In these systems each job element or task is pre-scaled in terms of its related attribute requirements. However, there is little empirical evidence to indicate that such procedures are proportionately more effective in accurately identifying those job-related individual difference factors that would be optimal for purposes of job grouping and validity generalization (Desmond & Weiss, 1973; Levine, Bennett & Ash, 1977; Prien, 1977).

To summarize, the attribute requirements approach to job family development appears to offer the most value in terms of the various validity generalization applications discussed earlier in this section. This is because, for such personnel selection applications, the main variables of interest, and hence those which make the most sense to use as the units of analysis for job grouping, are those human attribute factors which most directly account for individual differences in job performance effectiveness. Another advantage of this approach lies in the fact that, as we have seen, it is likely to open up a broader range of possibilities for validity generalization than would ordinarily be revealed by looking for such generalizability solely within job families constructed on the basis of job- or worker-oriented content descriptors.

As one example of a way in which this approach might be applied, the work of both Ghiselli (1966) and Maier and Fuchs (1969, 1972) suggests the feasibility of constructing families of jobs, homogeneous with respect to their attribute requirements, on the basis of similarity in their test validity profiles. Validities would thus generalize within such families by the nature of the way in which they were constructed. The key to such an application, of course, lies in the accumulation of stable data relating individual attribute differences to performance on a wide variety of jobs, as the result of either a series of large-sample

validation studies (as was the case in the Army research) or an accumulation of a large number of small-sample studies (Ghiselli's approach).

The results reported by Schmidt and Hunter (Note 3) for clerical job families suggest an alternative approach to job family construction when the purpose is more basic theoretical research aimed at fully exploring a wide range of possible job groupings within which test validities might be found to generalize. This strategy involves starting out with a rationally based job family structure, compiling all available prior validity results for different types of tests within such families, and then statistically determining the extent to which the effects of possible situational moderators or task differences between jobs in a given family could be large enough to affect validity generalizability. If such effects are not large, as was the case for almost all of the test type-job family combinations examined in the Schmidt and Hunter study, there is strong evidence for the homogeneity of the job family in terms of its attribute requirements.

An approach such as this, apart from its practical implications in terms of validity generalization, has significant theoretical implications as well. Although both Dunnette (1976) and Fleishman (1975) concur that an attribute requirements approach provides the essential integrative framework or linkage function necessary to bridge the gap between the structure of work and human individual differences, the framework they envision appears to be one in which attribute requirements are systematically related to certain patterns or combinations of molecular work units, such as tasks or worker-oriented elements. Yet if consistent and generalizable patterns of validities were found within jobs that have been rationally classified into families on the basis of similarities in their general activity and content structure (as would be the case when a job-analysis-based classification structure such as the DOT is used as a starting point), the necessity for molecular analysis of the job-specific tasks or elements of individual jobs might well be obviated, at least for purposes of validity generalization. In addition, such a discovery would in essence lay the groundwork for a science, rather than a technology, of personnel selection (Guion, 1976), since it would demonstrate a basic rationality, relative simplicity, and consequent

generalizability of human job requirements underlying the structure of work, rather than the apparent chaos, complexity, and situational specificity of job analysis and test validation results that has long plagued the field. Such a possibility, while idealistic, does not appear that far-fetched in view of some of the research reviewed above.

In addition to continued research along the lines suggested by the work of Ghiselli, Maier and Fuchs, and Schmidt and Hunter, another useful avenue of future research in this area would be one which systematically explored, using a common set (and preferably a wide variety) of jobs, the effects of different job grouping strategies on the generalizability of validities within the resulting job families. Such an effort would require, for each job, both job-oriented and worker-oriented descriptor output, as well as stable validity data on a variety of attribute-oriented predictors. Research of this nature would provide a more definitive answer to the question of the relative utility of different types of job families for personnel selection than is presently available.

REFERENCE NOTES

1. Dunnette, M. D. *Task and job taxonomies as a basis for evaluating employment qualifications*. Paper presented at the Conference on Affirmative Action Planning Concepts, Cornell University, October 31-November 2, 1977.
2. Goodfellow, R. A. H., & Grossen, N. E. *The development of a general job analytic methodology for assessing validity generalization and operationally defined constructs of job performance*. Research proposal, California State University, April 1977.
3. Schmidt, F. L., & Hunter, J. E. *Development and test of a general solution to the problem of validity generalization*. James McKeen Cattell Award Invited Address at the meeting of the American Psychological Association, San Francisco, August 1977.
4. Schmidt, F. L. Personal communication, November 14, 1977.

REFERENCES

- American Bankers Association. *Test battery for entry level positions in banking: Technical report*. Washington, D. C.: Author, 1977.
- Archer, W. B. *Computation of group job descriptions from occupational survey data* (PRL-TR-66-12). Lackland Air Force Base, Tex.: Personnel Research Laboratory, Aerospace Medical Division, December 1966. (NTIS No. AD-653 543).
- Arvey, R. D., & Mossholder, K. M. A proposed methodology for determining similarities and differences among jobs. *Personnel Psychology*, 1977, 30, 363-374.
- Barnette, W. L., Jr. Occupational aptitude pattern research. *Occupations*, 1950, 29, 5-12.
- Bingham, W. V. Classifying and testing for clerical jobs. *Personnel Journal*, 1935, 14, 163-172.
- Blashfield, R. K. Mixture model tests of cluster analysis: Accuracy of four agglomerative hierarchical methods. *Psychological Bulletin*, 1976, 83, 377-388.
- Borgen, F. H., & Weiss, D. J. Cluster analysis in counseling research. *Journal of Counseling Psychology*, 1971, 18, 583-591.
- Canada Department of Manpower and Immigration. *Canadian classification and dictionary of occupations 1971* (2 vols.). Information Canada, 1973.
- Cardall, A. J. A test for primary business interests based on a functional occupational classification. *Educational and Psychological Measurement*, 1942, 2, 113-138.
- Carr, M. J. *The SAMOA method of determining technical, organizational, and communicational dimensions of task clusters* (Technical Bulletin STB 68-5). San Diego: U. S. Naval Personnel Research Activity, November 1967.
- Chalupsky, A. B. Comparative factor analysis of clerical jobs. *Journal of Applied Psychology*, 1962, 46, 62-66.

- Christal, R. E. *The United States Air Force occupational research project* (AFHRL-TR-73-75). Lackland Air Force Base, Tex.: Air Force Human Resources Laboratory, Occupational Research Division, January 1974. (NTIS No. AD-774 574/8GI)
- Colbert, G. A., & Taylor, L. A. Empirically derived job families as a foundation for the study of validity generalization: Study III. Generalization of selection test validity. *Personnel Psychology*, in press.
- Coombs, C. H., & Satter, G. A. A factorial approach to job families. *Psychometrika*, 1949, 14, 33-42.
- Cronbach, L. G., & Gleser, G. C. Assessing similarity between profiles. *Psychological Bulletin*, 1953, 50, 456-473.
- Cunningham, J. W., Phillips, M. R., & Spetz, S. H. *An exploratory study of a job-component approach to estimating the human ability requirements of job classifications in a state competitive service system*. Raleigh, N. C.: North Carolina Office of State Personnel, 1976.
- DeNisi, A. S. The implications of job clustering for training programmes. *Journal of Occupational Psychology*, 1976, 49, 105-113.
- DeNisi, A. S., & McCormick, E. J. *The cluster analysis of jobs based on data from the Position Analysis Questionnaire (PAQ)* (Report No. 7). West Lafayette, Ind.: Purdue University, Department of Psychological Sciences, September 1974.
- Desmond, R. E., & Weiss, D. J. Supervisor estimation of abilities required in jobs. *Journal of Vocational Behavior*, 1973, 3, 181-194.
- Dodge, A. F. *Occupational ability patterns* (Teachers College Contributions to Education No. 658). New York: Columbia University Teachers College, 1935.
- Dunnette, M. D. Aptitudes, abilities, and skills. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*. Chicago: Rand McNally, 1976.
- Dunnette, M. D., Kirchner, W. K. A check list for differentiating different kinds of sales jobs. *Personnel Psychology*, 1959, 12, 421-429.
- Dvorak, B. J. *Differential occupational ability patterns* (Bulletin of the Employment Stabilization Research Institute No. 8). Minneapolis: University of Minnesota Press, 1935.
- English, H. B., & English, A. C. *A comprehensive dictionary of psychological and psychoanalytic terms*. New York: Longmans, Green and Co., 1958.
- Farina, A. J., Jr., & Wheaton, G. R. Development of a taxonomy of human performance: The task characteristics approach to performance prediction. *JSAS Catalog of Selected Documents in Psychology*, 1973, 3, 26-27. (Ms. No. 323)
- Fine, S. A., & Wiley, W. *An introduction to functional job analysis: a scaling of selected tasks from the social welfare field* (Methods for Manpower Analysis No. 4). Upjohn Institute, September 1971.
- Fleishman, E. A. Toward a taxonomy of human performance. *American Psychologist*, 1975, 30, 1127-1149.
- Ghiselli, E. E. *The validity of occupational aptitude tests*. New York: Wiley, 1966.
- Guilford, J. P., Christensen, P. R., Bond, N. A., Jr., & Sutton, M. A. A factor analysis study of human interests. *Psychological Monographs*, 1954, 68 (4, Whole No. 375).
- Guion, R. M. Recruiting, selection, and job placement. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*. Chicago: Rand McNally, 1976.
- Harding, F. D., & Downey, R. L., Jr. *Electronic engineer job types in the Air Force Systems Command* (PRL-TDR-64-8). Lackland Air Force Base, Tex.: Personnel Research Laboratory, Aerospace Medical Division, March 1964. (NTIS No. AD-602,447)

- Hawk, J. Linearity of criterion-GATB aptitude relationships. *Measurement and Evaluation in Guidance*, 1970, 2, 249-251.
- Hemphill, J. K. *Dimensions of executive positions: A study of the basic characteristics of the positions of ninety-three business executives*. (Bureau of Business Research Monograph No. 98). Columbus, Ohio: Ohio State University, College of Commerce and Administration, 1960.
- Holland, J. L., Viernstein, M. C., Kuo, H., Karweit, N. L., & Blum, Z. D. A psychological classification of occupations. *JSAS Catalog of Selected Documents in Psychology*, 1972, 2, 84. (Ms. No. 184)
- International Labour Office. *International standard classification of occupations*. Geneva: Author, 1969.
- Jeanneret, P. R., & McCormick, E. J. *The job dimensions of "worker-oriented" job variables and of their attribute profiles as based on data from the Position Analysis Questionnaire* (Report No. 2). Lafayette, Ind.: Purdue University, Occupational Research Center, June 1969.
- Kuder, G. F. *Manual to the Kuder Preference Record*. Chicago: Science Research Associates, 1946.
- Landy, F. J. A procedure for occupational clustering. *Organizational Behavior and Human Performance*, 1972, 8, 109-117.
- Lawshe, C. H., & Balma, M. J. *Principles of personnel testing* (2nd ed.). New York: McGraw-Hill, 1966.
- Levine, E. L., Bennett, L. J., & Ash, R. A. Exploratory comparative study of four job analysis methods. Phoenix, Ariz.: Arizona State Personnel Division, 1977.
- Levine, J. M., Romashko, T., & Fleishman, E. A. Evaluation of an abilities classification system for integrating and generalizing human performance research findings: An application to vigilance tasks. *Journal of Applied Psychology*, 1973, 58, 149-157.
- McCormick, E. J. The development of processes for indirect or synthetic validity: III. Application of job analysis to indirect validity. A symposium. *Personnel Psychology*, 1959, 12, 402-413.
- McCormick, E. J. Job and task analysis. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*. Chicago: Rand McNally, 1976.
- McCormick, E. J., Finn, R. H., & Scheips, C. D. Patterns of job requirements. *Journal of Applied Psychology*, 1957, 41, 358-364.
- McCormick, E. J., Jeanneret, P. R., & Mecham, R. C. A study of job characteristics and job dimensions as based on the Position Analysis Questionnaire (PAQ). *Journal of Applied Psychology*, 1972, 56, 347-368.
- Maier, M. H., & Fuchs, E. F. *Development of improved aptitude area composites for enlisted classification* (Technical Research Report 1159). Arlington, Va.: U. S. Army Behavioral Science Research Laboratory, September 1969. (NTIS No. AD-701 134)
- Maier, M. H., & Fuchs, E. F. *Development and evaluation of a new ACB and aptitude area system* (Technical Research Note 239). Arlington, Va.: U. S. Army Behavior and Systems Research Laboratory, September 1972. (NTIS No. AD-751 761)
- Marquardt, L. D., & McCormick, E. J. *The job dimensions underlying the job elements of the Position Analysis Questionnaire (PAQ) (Form B)* (Report No. 4). Lafayette, Ind.: Purdue University, Department of Psychological Sciences, Occupational Research Center, June 1974.
- Meir, E. I. *Structural elaboration of Roe's classification of occupations*. Jerusalem: Israel Program for Scientific Translations, 1968.
- Mobley, W. H., & Ramsay, R. S. Hierarchical clustering on the basis of inter-job similarity as a tool in validity generalization. *Personnel Psychology*, 1973, 26, 213-225.

- Morsh, J. E. *Identification of job types in the personnel career field* (PRL-TR-65-9). Lackland Air Force Base, Tex.: Personnel Research Laboratory, Aerospace Medical Division, April 1965. (NTIS No. AD-622-433)
- Norman, W. T. A spatial analysis of an interest domain. *Educational and Psychological Measurement*, 1960, 20, 347-361.
- Orr, D. B. A new method for clustering jobs. *Journal of Applied Psychology*, 1960, 44, 44-49.
- Osgood, C. E., & Suci, G. J. A measure of relation determined by mean differences and profile information. *Psychological Bulletin*, 1952, 49, 251-262.
- Page, R. *An interjurisdictional validation of selection procedures for clerical and related positions in the State of Minnesota* (Technical Report No. 14). St. Paul, Minn.: Minnesota Department of Personnel, Division of Recruitment and Selection, July 1975.
- Palmer, G. J., & McCormick, E. J. A factor analysis of job activities. *Journal of Applied Psychology*, 1961, 45, 289-294.
- Paterson, D. G., Gerken, C. d'A., & Hahn, M. E. *Revised Minnesota Occupational Rating Scales*. Minneapolis: University of Minnesota Press, 1953.
- Prien, E. P. Development of a supervisor position description questionnaire. *Journal of Applied Psychology*, 1963, 47, 10-14.
- Prien, E. P. Development of a clerical position description questionnaire. *Personnel Psychology*, 1965, 18, 91-98.
- Prien, E. P. The function of job analysis in content validation. *Personnel Psychology*, 1977, 30, 167-174.
- Remstad, K., & Rothney, J. W. M. Occupational classification and research results. *Personnel and Guidance Journal*, 1958, 36, 465-472.
- Riccobono, J. A., Cunningham, J. W. Work dimensions derived through systematic job analysis: A study of the Occupation Analysis Inventory. *JSAS Catalog of Selected Documents in Psychology*, 1974, 4, 145. (Ms. No. 806)
- Roe, A. *The psychology of occupations*. New York: Wiley, 1956.
- Roter, B. An integrated framework for personnel utilization and management. *Personnel Journal*, 1973, 52, 1031-1059.
- Schmidt, F. L., & Hunter, J. E. Development of a general solution to the problem of validity generalization. *Journal of Applied Psychology*, 1977, 62, 529-540.
- Schmidt, F. L., Hunter, J. E., & Urry, V. W. Statistical power in criterion-related validity studies. *Journal of Applied Psychology*, 1976, 61, 473-485.
- Schoenfeldt, L. F. Utilization of manpower-development and evaluation of an assessment-classification model for matching individuals. *Journal of Applied Psychology*, 1974, 59, 583-595.
- Seymour, G. E., Gunderson, E. K. E., & Vallacher, R. R. Clustering 34 occupational groups by personality dimensions. *Educational and Psychological Measurement*, 1973, 33, 267-284.
- Shartle, C. L. Vocational guidance and job families. *Occupations*, 1942, 20, 506-508.
- Shartle, C. L. *Occupational information* (3rd ed.). Englewood Cliffs, N. J.: Prentice-Hall, 1959.
- Strong, E. K., Jr. *Vocational interests of men and women*. Palo Alto: Stanford Univ. Press, 1943.
- Taylor, L. R. Empirically derived job families as a foundation for the study of validity generalization: Study I. The construction of job families based on the component and overall dimensions of the PAQ. *Personnel Psychology*, in press.
- Taylor, L. R., & Colbert, G. A. Empirically derived job families as a foundation for the study of validity generalization: Study II. The construction of job families based on company-specific PAQ job dimensions. *Personnel Psychology*, in press.
- Tenopir, M. L. Content-construct confusion. *Personnel Psychology*, 1977, 30, 47-54.
- Theologus, G. C., & Fleishman, E. A. *Development of a taxonomy of human performance: Validation study of ability scales for classifying human tasks* (Technical Report No. 10). Washington, D. C.: American Institutes for Research, 1971.

- Thomas, L. L. A cluster analysis of office occupations. *Journal of Applied Psychology*, 1952, 36, 238-242.
- Thorndike, R. L. Who belongs in the family? *Psychometrika*, 1953, 18, 267-276.
- Thorndike, R. L., & Hagen, E. P. *Ten thousand careers*. New York: Wiley, 1959.
- Thorndike, R. L., Hagen, E. P., Orr, D. B., & Rosner, B. An empirical approach to the determination of Air Force job families (AFPTRC-TR-57-5). Lackland Air Force Base, Tex.: Air Force Personnel and Training Research Center, August 1957. (NTIS No. AD-134 239)
- Thurstone, L. L. A multiple factor study of vocational interests. *Personnel Journal*, 1931, 10, 198-205.
- Toops, H. A. Some concepts of job families and their importance in placement. *Educational and Psychological Measurement*, 1945, 5, 195-216.
- Tornow, W. W., & Pinto, P. R. The development of a managerial job taxonomy: A system for describing, classifying, and evaluating executive office positions. *Journal of Applied Psychology*, 1976, 61, 410-418.
- Trabue, M. R. Occupational ability patterns. *Personnel Journal*, 1933, 11, 344-351.
- Tryon, R. C., & Bailey, D. E. *Cluster analysis*. New York: McGraw-Hill, 1970.
- U. S. Bureau of the Census. *1970 census of population classified index of industries and occupations*. Washington, D. C.: U. S. Government Printing Office, 1971.
- U. S. Civil Service Commission. *Handbook of occupational groups and series of classes*. Washington, D. C.: U. S. Government Printing Office, 1973.
- U. S. Department of Commerce, Office of Federal Statistical Policy and Standards. *Standard occupational classification manual*. Washington, D. C.: U. S. Government Printing Office, 1977.
- U. S. Department of Justice. Employee selection guidelines. *Federal Register*, 1976, 41 (227), 51734-51759.
- U. S. Department of Labor, Manpower Administration. *Dictionary of occupational titles* (Vol. II) (3rd ed.). Washington, D. C.: U. S. Government Printing Office, 1965.
- U. S. Department of Labor, Manpower Administration. *Manual for the USTES General Aptitude Test Battery, Section III: Development*. Washington, D. C.: U. S. Government Printing Office, 1970.
- U. S. Department of Labor, Employment and Training Administration. *Dictionary of Occupational Titles* (4th ed.). Washington, D. C.: U. S. Government Printing Office, 1977.
- U. S. Equal Employment Opportunity Commission. Guidelines on employee selection procedures. *Federal register*, 1970, 35 (149), 12333-12336.
- U. S. Equal Employment Opportunity Coordinating Council. Uniform guidelines on employee selection procedures. *Federal Register*, 1977, 42 (251), 65542-65552.
- The United States Law Week*, 1975, 43, 4880-4895.
- Ward, J. H. Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 1963, 58, 236-244.
- Wiley, L. N., Jenkins, W. S., Cagwin, L. P., & Kudrick, H. M. *Job types of communications officers*, DAFSC 3034 (PRL-TR-66-17). Lackland Air Force Base, Tex.: Personnel Research Laboratory, Aerospace Medical Division, November 1966. (NTIS No. AD-658 025)